

**(1) MLE for Bernoulli distribution:** Let variable  $\mathcal{X}$  follow a Bernoulli distribution with parameter  $p$ , i.e., the probability of  $x$  is  $f(x) = p^x(1-p)^{1-x}$ . If the set of independent and identically distributed data (i.i.d.) samples  $\mathcal{X} = \{x_1, \dots, x_N\}$  follows the Bernoulli distribution, derive the maximum likelihood estimate (MLE) for  $p^{MLE}$ .

**(2) MLE for exponential distribution:** Let variable  $\mathcal{X}$  follow an exponential distribution with parameter  $\lambda$ , i.e., the probability of  $x$  is  $f(x) = \lambda e^{-\lambda x}$ . If the set of independent and identically distributed data (i.i.d.) samples  $\mathcal{X} = \{x_1, \dots, x_N\}$  follows the exponential distribution, derive the maximum likelihood estimate (MLE) for  $\lambda^{MLE}$ .